Times

Del Mar Analytical

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Perchlorate by Ion Chromatography

Much interest has been generated in the past year regarding perchlorate contamination in drinking water wells. At high levels, perchlorate has been shown to interfere with the thyroid gland's ability to use iodine to produce hormones. Normal metabolism, growth and development are affected. Worst case scenarios show brain damage in fetuses and a potentially fatal form of anemia in adults.

Generated from sources mainly in California and Nevada, perchlorate is also sneaking into Arizona via the Colorado River. Perchlorate (ClO_4) is the oxidation product of chlorate (ClO_3) and appears in such compounds as ammonium perchlorate, potassium perchlorate, sodium perchlorate, and perchloric acid. Ammonium perchlorate is the prime ingredient in solid rocket-fuels. From childhood hobby kits to the twin boosters that help launch the space shuttle, ammonium perchlorate acts as the oxidizer which enables the rocket fuel to ignite and burn. Responsible for the red and blue colors of fireworks, ammonium perchlorate is also used in munitions, explosives, chrome plating and match manufacturing.

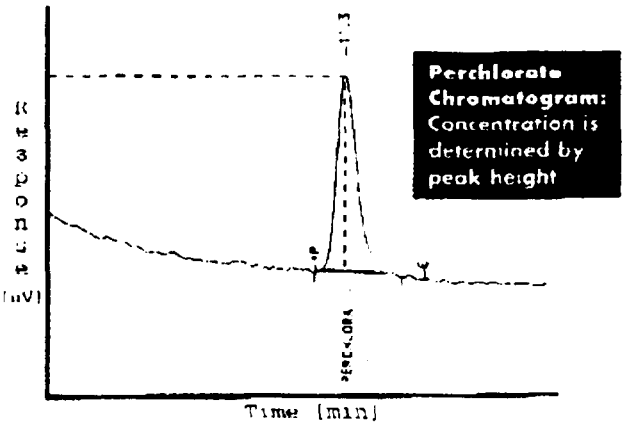
Since it is highly reactive in its solid state and has a limited shelf life, perchlorate must be periodically washed out of missile and rocket inventories and replaced with a fresh supply. Therefore, large volumes of the compound have been disposed of in California and other sites since the 1950's. In Southern California, the contaminant is thought to have emanated from such commercial companies as the old Lockheed Propulsion Co. (solid rocket fuels) in Redlands, both Aerojet (solid rocket motors) and the Day and Night Manufacturing Co. (airborne flares) in Azusa, JPL (solid rockets) in Pasadena, and the old B.F. Goodrich plant in Rialto.

The military has also been targeted—groundwater tests are slated for Vandenberg Air Force Base (a major military rocket launching facility) and Edwards Air Force Base (a military test installation). Manufacturers of perchlorate in the United States are the Kerr McGee Chemical Corp. in Henderson, Nevada and American Pacific Corp., originally in production at Henderson and currently operating in Cedar City, Utah.

In June of 1997, the California Department of Health Services released a modified version of EPA Method 300.0, an Ion Chromatography method, developed specifically for perchlorate analysis. To gain CA DHS approval, laboratories were required to generate a perchlorate data package, submit a method detection limit study, provide a written Standard Operating Procedure and Quality Assurance program, successfully analyze a Performance Evaluation sample provided by the DHS, and pass an on-site audit. Del Mar Analytical completed this procedure and received its approval letter in January.

The new method utilizes a special column and a sodium hydroxide solution as an eluent (the solvent that carries the perchlorate ion through the column). Sodium bicarbonate is the solution used for common anions such as nitrate or sulfate. Sodium hydroxide, a very strong eluent, is required for perchlorate analysis due to the high reactivity of the perchlorate ion. Perchlorate concentration is determined by the height of the resulting peak (see below). Because of the different columns and eluent solutions, it is not practical to perform both the standard EPA Method 300.0 for anions and the new modified 300.0 method for perchlorate on the same instrument. Therefore, Del Mar Analytical has installed **a new Ion Chromatograph (a Dionex model)** in its Irvine laboratory dedicated solely for perchlorate analyses.

No promulgated Maximum Contaminant Level exists for perchlorate; however, the CA DHS has adopted a provisional standard for perchlorate in drinking water of 18 ug/L. The preferred reporting limit is 4 ug/L in water. An industry standard reporting limit does not exist at this time for soil samples. The required sample volume and container for water samples is a 500 ml unpreserved polyethylene bottle. We are assuming a 28 day analysis hold time, equal to that of chloride and sulfate, since a published hold time does not yet exist.



Perchlorate Chromatogram: Concentration is determined by peak height

TEMPE, AZ OFFICE (602) 968-8272 KAREN GRAVES